

## CLAIMS

What is claimed is:

1. A variable capacity compressor system that is operable in a normal mode and a rapid transient mode selected from an upward and a downward variation, comprising:

a compressor that compresses a fluid;

a motor that drives said compressor; and

a controller that selects a power source for said motor, said power source being either a main power source when operating in said normal mode or a supplemental power source when operating in said rapid transient mode which is upward.

2. The variable capacity compressor system of claim 1 wherein when in said normal mode said controller controls said motor to maintain a first capacity.

3. The variable capacity compressor system of claim 1 wherein when in said rapid transient mode said controller adjusts said motor from a first capacity to a second capacity.

4. The variable capacity compressor system of claim 3 wherein said second capacity is greater than said first capacity when operating in said rapid transient mode which is upward.

5. The variable capacity compressor system of claim 3 wherein said second capacity is less than said first capacity when operating in said rapid transient mode which is downward.
6. The variable capacity compressor system of claim 1 wherein said supplemental power source is a capacitor.
7. The variable capacity compressor system of claim 1 wherein said controller controls charging of said supplemental power source during said normal mode.
8. The variable capacity compressor system of claim 1 wherein when in said upward rapid transient mode, said controller implements power from said supplemental power source to increase motor speed.
9. The variable capacity compressor system of claim 1 wherein said controller regeneratively brakes said motor to produce charging current when operating in said rapid transient mode which is downward.

10. A fuel cell system, comprising:
- a fuel cell that processes an oxidant to produce electrical energy;
  - a variable capacity compressor system that supplies said oxidant to said fuel cell and that is operable in a normal mode and a rapid transient mode selected from an upward and downward variation, said variable capacity compressor system comprising:
    - a compressor that compresses said oxidant; and
    - a controller that monitors a power demand from said fuel cell and that selects a power source for said compressor, said power source being either a main power source when operating in said normal mode or a supplemental power source when operating in said rapid transient mode which is upward.
11. The fuel cell system of claim 10 wherein said compressor system comprises a motor that drives said compressor; and when in said normal mode said controller controls said motor to maintain a first capacity.
12. The fuel cell system of claim 10 wherein said compressor system comprises a motor that drives said compressor; and when in said rapid transient mode said controller operates said motor to transfer from a first capacity to a second capacity.

13. The variable capacity compressor of claim 12 wherein said second capacity is greater than said first capacity when operating in said rapid transient mode which is upward.

14. The variable capacity compressor of claim 12 wherein said second capacity is less than said first capacity when operating in said rapid transient mode which is downward.

15. The fuel cell system of claim 10 wherein said supplemental power source is a capacitor.

16. The fuel cell system of claim 10 wherein said controller controls charging of said supplemental power source during said normal mode.

17. The fuel cell system of claim 16 wherein charging is achieved using power generated by said fuel cell.

18. The fuel cell system of claim 10 wherein said compressor system comprises a motor that drives said compressor; and when said rapid transient mode is upward, said controller uses power from said supplemental power source to increase motor speed.

19. The fuel cell system of claim 10 wherein said compressor system comprises a motor that drives said compressor; and said controller regeneratively brakes said motor to produce charging current when operating in said rapid transient mode which is downward.

20. The fuel cell system of claim 10 wherein said controller shifts said variable capacity compressor between said normal mode and said rapid transient mode based on said power demand.

21. A method of operating a variable capacity compressor system, comprising:

operating said variable capacity compressor in a normal mode at a first capacity;

powering said variable capacity compressor from a main power source during said normal mode;

adjusting said variable capacity compressor from said first capacity to a second capacity when in a rapid transient mode; and

when in said rapid transient mode either:

a) powering said variable capacity compressor from a supplemental power source when said rapid transient mode is an upward rapid transient mode, or

b) regeneratively braking a motor associated with said compressor to produce charging current for said supplemental power source when operating in said rapid transient mode which is a downward rapid transient mode.

22. The method of claim 21 wherein said second capacity is greater than said first capacity when operating in said upward rapid transient mode.

23. The method of claim 21 wherein said second capacity is less than said first capacity wherein operating in said downward rapid transient mode.

24. The method of claim 21 wherein said supplemental power source is a capacitor.

25. The method of claim 21 further comprising charging said supplemental power source during said normal mode.

26. The method of claim 21 further comprising using power from said supplemental power source to increase speed of a motor of said compressor when in said upward rapid transient mode.